

ACCESSION #: 9706110303

NON-PUBLIC?: N

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Davis-Besse Unit Number 1 PAGE: 1 OF 5

DOCKET NUMBER: 05000346

TITLE: Reactor Trip Due To Main Transformer Deluge System

Actuation

EVENT DATE: 05/04/97 LER #: 97-010-00 REPORT DATE: 06/03/97

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Gerald M. Wolf, Engineer-Licensing TELEPHONE: (419) 321-8114

COMPONENT FAILURE DESCRIPTION:

CAUSE: X SYSTEM: IC COMPONENT: TIS MANUFACTURER: X999

REPORTABLE NPRDS: N

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On May 4, 1997, at 1731 hours, with the plant at 100 percent power, the Main Transformer Deluge System automatically actuated due to a degraded temperature sensor in the transformer fire detection system. At 1735 hours, a flashover occurred when the Main Transformer faulted to ground due to the deluge system actuation. The Main Generator locked out on overall differential current, which initiated a trip of the Main Turbine and a subsequent reactor trip by the Anticipatory Reactor Trip System. The plant was cooled down to replace the Main Transformer that was damaged as a result of the

flashover. The temperature sensors that actuate the deluge system have been replaced with a different type of temperature sensor to prevent inadvertent actuation, and four nozzles near the top of the transformer have been realigned to reduce the chances of a transformer flashover upon a deluge system actuation. This event is being reported in accordance with 10CFR50.73(a)(2)(iv).

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Description of Occurrence:

On May 4, 1997, at 1731 hours, with the plant in Mode 1 operating at 100 percent power, the Main Transformer Deluge System [Energy Industry Identification System KP] automatically actuated. Following receipt of alarms, control room personnel sounded the Station Fire Alarm and dispatched the Fire Brigade. When operators arrived at the Main Transformer [EL-XFMR], they observed the deluge of the transformer with mist rising from the transformer due to the deluge actuation. No evidence of any fire was seen. At 1735 hours, the operators witnessed a flashover of the Main Transformer. The Main Generator locked out on overall differential current due to phase C of the transformer faulting to ground, which initiated a trip of the Main Turbine [TA]. Upon the trip of the Main Turbine, the Anticipatory Reactor Trip System (ARTS) opened the Control Rod Drive [AA] Trip Breakers to trip the reactor. Unit response to the reactor trip was as designed. Plant parameters stabilized within their normal post-trip values. One Main Steam Safety Valve (MSSV), SP17B7, was slow in resealing which required a reduction in Main Steam header pressure to less than 970 pounds per square inch to reseal.

Initial notification of this automatic actuation of an engineered safety feature was made to the NRC at 1941 hours on May 4, 1997, in accordance with the four-hour reporting requirement of 10CFR50.72(b)(2)(ii). This report is being submitted as an LER in accordance with 10CFR50.73(a)(2)(iv).

Subsequent testing of the Main Transformer showed that the flashover may have caused shifting of the transformer windings. The plant was then cooled down to Mode 5 to replace the Main Transformer with a spare unit. During this shutdown, MSSV SP17B7 was replaced with a tested spare.

Apparent Cause of Occurrence:

The reactor trip resulted from the Main Transformer flashover during the transformer deluging with the transformer energized. There was no evidence found indicating that the Main Transformer deluge system actuated in response to overheating or fire at the Main Transformer. The most probable cause of the deluge system actuation is that a Main Transformer fire detection system temperature sensor [IC-TIS], with a degraded setpoint, sensed a high enough temperature to actuate the deluge system. There are 24 temperature sensors installed around the Main Transformer and its associated cooling banks. The setpoint for these sensors is approximately 200 degrees Fahrenheit. The sensors also actuate on a rapid rate of rise in temperature. Any one of these 24 temperature sensors can independently actuate the Main Transformer Deluge System. All 24 sensors were tested following the event, and the lowest

actuation reading was 155 degrees Fahrenheit in a heated water bath.

Based on tell-tale indications, the maximum Main Transformer winding temperature indicated was 185 degrees Fahrenheit, while the maximum Main Transformer oil temperature indicated was 178 degrees Fahrenheit. These temperatures are sufficient to actuate the low reading sensor.

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Apparent Cause of Occurrence (Continued):

On May 1, 1997, the continuously operating and cycling groups of Main Transformer cooling fans were swapped. This resulted in the suspected low setpoint sensor being directly in front of the cycling group instead of the continuously operating group of fans. The cycling group of cooling fans is automatically started at an indicated winding temperature of 185 degrees Fahrenheit and shut down at 180 degrees Fahrenheit. It is postulated that when the cycling group energized at its setpoint, the initial flow of hot air directed at the sensor caused it to actuate. The temperature sensor design includes a rate of rise feature that may have allowed it to actuate at even a lower temperature.

Examination of the temperature sensor with the low setpoint revealed a small amount of corrosion on the sensor's internals. According to the detector system vendor representative, this small amount of corrosion would cause the setpoint to be reduced to the value measured. This sensor was installed during initial construction, and has been in service for over 20 years.

The Main Transformer deluge system is a water spray system, consisting of open nozzles designed to provide 0.25 gallons per minute of water to every square foot of transformer surface. Actuation of the deluge system results in the discharge of water from all 168 spray nozzles, as well as open sprinklers over the nearby Turbine Building train bay roll-up door. The deluge system is designed to cool the transformer and extinguish fires without necessarily causing a flashover and resultant actuation of the transformer protection circuitry. An examination of the all transformer deluge system spray nozzles revealed that most nozzles were not aimed slightly down as recommended by the deluge system manufacturer. Four of the nozzles near the top of the Main Transformer were aimed slightly upward, which would contribute to a flashover upon a deluge system actuation. At the time of the event, there were sustained winds of over 15 miles per hour with gusts up to 30 miles per hour, which could have contributed to the flashover. Proper aiming of the nozzles would reduce the chance of transformer flashover upon actuation of the deluge system, but unless weather conditions are optimum, a flashover may still occur.

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Analysis of Occurrence:

There were no safety concerns identified during or as a result of this event. ARTS functioned properly when the Main Turbine tripped to open the Control Rod Drive Trip Breakers, and all control rods inserted on the

reactor trip as designed. The Reactor Protection System [JC] functioned properly to trip on low pressure during the normal post-trip Reactor Coolant System pressure decrease following the reactor trip. The Steam Generator outlet pressure increased due to the closing of the Main Turbine Stop Valves [TA-ISV]. The Turbine Bypass Valves (TBVs)[SB-PCV] and the Atmospheric Vent Valves (AVVs) [SB-PCV] opened and the Main Steam Safety Valves (MSSVs)[SB-RV] lifted in response to the increasing secondary system pressure. The MSSVs and the AVVs closed as Steam Generator outlet pressure decreased. The TBVs controlled Steam Generator outlet pressure at the post-trip setpoint. The Safety Features Actuation System [JE] and the Steam and Feedwater Rupture Control System [JB] were not challenged during this event.

Corrective Actions:

The existing Main Transformer temperature sensors have been replaced with temperature sensors that have a higher setpoint of approximately 275 degrees Fahrenheit under Modification 97-0036. This should reduce the chances of spurious actuation of the Main Transformer Deluge System due to a decreased temperature sensor setpoint. These new temperature sensors, as well as the existing sensors on the Auxiliary Transformer, have been checked to ensure they actuate within acceptable values. The Main Transformer Deluge System Test will be revised to periodically check the temperature sensors to ensure the setpoint of the sensors has not drifted outside acceptable values. This test procedure will be revised

prior to the next performance of the deluge test, which is currently during the eleventh refueling outage. The eleventh refueling outage is currently scheduled to start in April, 1998. The deluge system tests for the other five outdoor transformers (Auxiliary, Startup, and Bus-Tie Transformers) will be similarly revised to periodically check the temperature sensors for unacceptable setpoint drift. These tests will also be revised prior to the next scheduled performance of the applicable deluge system tests. The Auxiliary Transformer Deluge System Test is scheduled for performance during the eleventh refueling outage, and the other four transformer deluge system tests are scheduled during September and October, 1997.

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Corrective Actions (continued):

The four nozzles near the top of the Main Transformer that were aimed slightly upward have been realigned to be aimed slightly downward to reduce the chances of a transformer flashover upon a deluge system actuation. The remainder of the deluge system nozzles for the Main Transformer will be realigned during the eleventh refueling outage so they are in accordance with the design of the deluge system.

Additionally, the deluge system nozzles for the Auxiliary Transformer will be realigned during the eleventh refueling outage, and the nozzles for the Startup and Bus-Tie Transformers will be realigned prior to the next scheduled performance of the applicable deluge system tests, to

ensure the nozzles are aligned in accordance with the design of the applicable deluge systems.

In addition, the current design of the transformer deluge systems will be evaluated. This evaluation will include both the fire detection and fire suppression portions of the deluge systems, and will consider industry experience with inadvertent transformer deluge actuations, and the consequences of these inadvertent actuations. This evaluation will be completed by September 30, 1997.

Failure Data:

In the past three years there have been no inadvertent actuations of the Main Transformer Deluge System or automatic trips of the reactor.

NP-33-97-010 PCAQR 97-0579

PCAQR 97-0660

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TOLEDO

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NP-33-97-010

AB-97-0099

Docket No. 50-346

License No. NPF-3

June 3, 1997

United States Nuclear Regulatory Commission

Document Control Desk

Washington, D.C. 20555

Ladies and Gentlemen:

LER 97-010

Davis-Besse Nuclear Power Station, Unit No. 1

Date of Occurrence - May 4, 1997

Enclosed please find Licensee Event Report 97-010, which is being submitted to provide 30 days written notification of the subject occurrence. This LER is being submitted in accordance with 10CFR50.73(a)(2)(iv).

Very truly yours,

James H. Lash

Plant Manager

Davis-Besse Nuclear Power Station

GMW/dlc

Enclosure

cc: Mr. A. B. Beach

Regional Administrator

USNRC Region III

Mr. Stan Stasek

DB-1 NRC Sr. Resident Inspector

Utility Radiological Safety Board

*** END OF DOCUMENT ***
